

IV. A SYSTEMATIC STUDY OF A COLLECTION OF MAMMALS FROM SOUTHERN ARIZONA.

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INTRODUCTION

The present paper is a report on a collection of mammals made by the author as a member of the Carnegie Museum Expedition to Arizona in 1927. The purpose of the report is to present a list of the mammals collected or observed, with notes on their life histories, range, and systematic status. An attempt has been made to assemble the pertinent literature dealing with these species in southeastern Arizona.

During the study, the large collection of mammals in the Museum of Vertebrate Zoology at Berkeley, California, was constantly used. Occasional use was made of the collection at the California Academy of Sciences at San Francisco.

The illustrations, unless otherwise indicated, are from photographs by the author.

I am much indebted to Dr. A. Avinoff, Director of the Carnegie Museum, and Dr. O. E. Jennings, Curator of Botany, for making the trip possible; to Dr. Forest Shreve, who so willingly rendered assistance and advice during our work in the field, and who also gave me permission to use part of his work on the Santa Catalina Mountains (Shreve 1915) in connection with the vegetational areas here discussed; to Dr. Joseph Grinnell and Dr. E. Raymond Hall, for their helpful criticism and guidance during the preparation of this report; and to my companions in the field, without whose warm friendship this trip, and many others, would have been much less profitable and enjoyable.

ITINERARY

The collection here reported upon was made between June 28 and August 31, 1927. Headquarters were established at Tucson, and collecting activities, with one exception, were confined to a radius of forty miles from that city.

The party at first consisted of Mr. E. H. Graham and Mr. H. W. Graham, botanists, and the author. Later, Mr. and Mrs. Ottmar Fuehrer and Mr. Ludwig Fuehrer joined the party for a few weeks to gather material for a plant habitat group to be erected in the Carnegie Museum.

Mammal collections were made at the following localities.

1. Base of Quinlin Mountains, forty miles southwest of Tucson, Pima County; between Upper Bajada and Lower Desert Slopes. (The names capitalized are of vegetational areas concerned—See p. 245.) June 28 and 29.
2. Florida Canyon (marked as Stone Cabin Canyon on U. S. G. S. topographic map, Arizona, Patagonia quadrangle, edition of 1905, reprint 1920), Santa Rita Mountains, Pima County; Upper Bajada and in small canyon of the Upper Desert Slopes. July 6-11.
3. Near Old Baldy Peak, 8450 feet, Santa Rita Mountains, Santa Cruz County; Fir Forest. July 13 and 14.
4. Peppersauce Canyon, 3000 feet, Santa Catalina Mountains, Pinal County; between Upper Bajada and Lower Desert Slopes. July 21.
5. Sonoran Desert, 1500 feet, 10 miles south of Florence, Pinal County; Lower Bajada. July 26.
6. Pinal Peak, 7800 feet, Pinal Mountains, near Globe, Gila County; Pine Forest. July 29.
7. Sonoran Desert, 1500 feet, 10 miles north of Florence, Pinal County; Lower Bajada. July 29.
8. Vicinity of Desert Laboratory, Tumamoc Hill, 2600 feet, near Tucson, Pima County; between Upper Bajada and Lower Desert Slopes. August 2, 16, and 19.
9. Mouth of Soldier Canyon, 3000 feet, Pima County; Desert Canyon and Upper Bajada. August 4-7, and 11.
10. Cat Mountain, 2600 feet, Tucson Mountains, Pima County; Upper Bajada. August 9.
11. Tucson, 2400 feet, Pima County. August 10.
12. Near Bear Canyon, 3400 feet, Tortolita Mountains, Pima County; Lower Desert Slopes. August 15.
13. Three miles northwest of Tucson, 2300 feet, Pima County; between Lower and Upper Bajada. August 15.
14. Near Soldier Camp, 8000 feet, Santa Catalina Mountains, Pima County; Pine and Fir Forest. August 17, 24-31.

15. Near Walnut, 3300 feet, 22 miles north of Tucson, base of Santa Catalina Mountains, Pinal County; Upper Bajada. August 17.

16. Near Oracle, 4600 feet, north base of Santa Catalina Mountains, Pinal County; Upper Bajada. August 20.

17. Near Stratton Mine, 4600 feet, north slope of Santa Catalina Mountains, Pima County; Lower Encinal. August 30.

GEOGRAPHY AND CHOROGRAPHY OF THE REGION

Southeastern Arizona presents three distinct geographic areas. To the north is the Grand Canyon Section of the Colorado Plateaus Province (see Fenneman, 1930), which consists of a series of high block plateaus trenched by the Grand Canyon. Above these plateaus rise several high mountains, such as the San Francisco Mountain and the White Mountains. Just south of this section is the Mexican Highland section of the Basin and Range Province, a narrow strip of country extending diagonally across the central part of the state from southern Nevada on the north to Mexico and New Mexico on the south and east. It is made up of isolated ranges, which are mainly dissected block mountains, separated by aggraded desert plains. South and west of this section lies the Sonoran Desert, a broad, level plain studded with low, short mountain ranges, and gradually sloping from an altitude of 3000 to 4000 feet at its northeast border along the Mexican Highland, to sea level at the Gulf of California. The division between the Mexican Highland and the Sonoran Desert passes just east of Tucson, along the west bases of the Santa Catalina and Santa Rita mountains. Thus the major portion of the collecting was done along the border between these two provinces.

These physiographic areas have an important effect on the flora and the fauna of the region. The forms found on the mountain tops are most closely related to species which occur farther to the north, while the forms found on the desert are representatives of southern species. The northern species range southward over the high mountains and plateaus, and find their southern limits on the mountains of the Mexican Highland, which project, like peninsulas, into a sea of desert plains. Erosion has separated certain of these mountains more or less effectively from the main mountain mass, so that they now rise, like islands, from the desert plain, and harbor isolated boreal forms. The desert-dwelling types reach their greatest elevation in the canyons, where the effect of altitude is felt most gradually.

Physiographically, the Santa Catalina, Santa Rita, and Huachuca mountains belong to the Mexican Highland Section, but they are separated from the other mountains of the series by the Gila and the San Pedro rivers, so that they are more closely connected with the Mexican Cordillera than with the Rocky Mountains. Although this separation has not produced any great differences in the flora and the fauna, minor differences do occur. In a more striking manner, the Gila and Salt rivers form a barrier to boreal forms across the Mexican Highland Section. In several cases, there are noticeable differences between species occurring to the north and south of these rivers. In some cases, these differences are sufficient to be recognized sub-specifically. For example, specimens of *Otospermophilus grammurus grammurus*, *Peromyscus maniculatus rufinus*, and *Sciurus arizonensis arizonensis*, occurring to the north, are more rufous in color than specimens to the south of this barrier. In the case of *Sciurus arizonensis*, the difference is sufficient to warrant the recognition of the subspecies *catalinae* to the south, and further study may prove that specimens of *P. m. rufinus* from south of the Gila and Salt rivers should also be recognized as a separate subspecies. The difference in specimens of *Otospermophilus* is likewise noteworthy, although perhaps not sufficient for subspecific rank. In a similar manner, this barrier forms the dividing line between *Junco phænotus palliatus*, occurring to the south, and *J. p. dorsalis*, occurring to the north.

Thus it is demonstrated, not only by our own observation, but by that of other naturalists who have worked in the region, that these geographic areas coincide with faunal and floral areas. Clements (1920, p. 171), Livingston and Shreve (1921, pp. 32-36), and Swarth (1928, pp. 269-283), all show a striking similarity in their definitions of the boundaries of this faunal and floral area. Mearns (1907, p. 74 and map pl. 2) also recognizes a faunal area in this vicinity, but he draws the boundary line about a hundred miles to the east, at the New Mexico-Arizona line.

VEGETATION OF THE REGION

The life zone concept as originally presented by Merriam was excellent, but many recent authors have found it desirable to subdivide, more minutely, the area under consideration. For example, see Mearns (1907, pp. 70-75); Grinnell (1914, pp. 62-96); Shreve

(1915, pp. 11-36); Clements (1920, pp. 172-177); Livingston and Shreve (1921, pp. 32-36); Swarth (1929, pp. 269-283).

The most thorough and accurate study of the vegetation of southeastern Arizona has been made by Shreve (1915). Although his discussion is limited to the Santa Catalina Mountains, it is applicable, with very slight additions, to the entire region in which collections were made; it is, therefore, used in the following discussion of the vegetation.

The desert plain, which surrounds the base of all the mountains in this region, extends from the Mexican Highland to the Gulf of California, and carries with it a characteristic flora and fauna. Greater changes in vegetation occur between the bases and the tops of such mountains as the Santa Rita and the Santa Catalina than in the entire distance between Tucson and the Gulf of California. These changes become more rapid as the steepness of the slope increases, and on such mountains as mentioned above, very definite floral areas occur. Shreve divides the vegetation into three main regions, the Desert, the Encinal, and the Forest. These regions are further subdivided as follows:

DESERT REGION

- Lower Bajada
- Upper Bajada
- Desert Arroyos and Canyons
- Lower Desert Slopes
- Upper Desert Slopes

ENCINAL REGION

- Lower Encinal
- Upper Encinal

FOREST REGION

- Pine Forest
- Fir Forest

The Desert Region is roughly comparable to the Lower Sonoran of Merriam, the Encinal to the Upper Sonoran, the Pine Forest to the Transition, and the Fir Forest to the Canadian.

DESERT REGION

LOWER BAJADA

The Lower Bajada is found on the lowest desert plains. The soil here is frequently alkaline, and the vegetation is much restricted in its variety of forms. The most characteristic plant is *Larrea tridentata* (Creosote Bush), and often this is the only plant occurring over wide areas. Other plants which enter this community are *Prosopis velutina* and several species of *Opuntia* (Prickly Pear).

UPPER BAJADA

The Upper Bajada consists of desert plains at slightly higher elevations than the Lower Bajada, and thus they are freer from the alkali which so reduces the vegetation of the latter region. Vegetation here is characterized by lowness of stature, openness of stand, and variety of species. Cactuses attain their maximum development in the Upper Bajada, both as to size and to variety of form. One of the most striking plants of this association is *Carnegiea gigantea* (Sahuarro or Giant Cactus), which finds its optimum habitat in the vicinity of the Santa Catalina Mountains. Other characteristic plants are *Prosopis velutina* (Mesquite), *Parkinsonia microphylla* (Palo Verde), *Fouquieria splendens* (Ocotillo), *Ferocactus wislizeni* (Barrel Cactus), *Simmondsia californica* (Jajobe), several species of *Opuntia* (Prickly Pear), and *Acacia greggii* (Cat Claw).

DESERT ARROYOS AND CANYONS

Desert Arroyos and Canyons vary in size from shallow drainage-ways, through which water runs for only a few hours after the severe summer rains, to large canyons or valleys through which a flow of water is constant. The smaller arroyos have no characteristic flora, but usually such plants as *Prosopis velutina* (Mesquite), *Acacia greggii* (Cat Claw), and *Mimosa pallida* grow more abundantly and more luxuriously along their borders. In arroyos large enough to have a heavy flow of storm water, there are, in addition, a number of characteristic species, such as *Parkinsonia torreyana*, *Cellis reticulata* (Western Hackberry), *Baccharis sarothroides* (Batamote), and *Chilopsis linearis*

(Desert Willow). In the largest canyons, where there is a flow of water for all or a large part of the year, mesophilous, palustrine, and even purely aquatic plants are found, in addition to the species found in the smaller arroyos. A few of these are *Populus* sp., *Fraxinus toumeyi* (Ash), *Juglans major*, *Platanus wrightii* (Sycamore), *Sapindus saponaria*, *Sambucus mexicana*, *Salix wrightii*, and three species of *Quercus*.

LOWER DESERT SLOPES

The Upper Bajada passes gradually into the Lower Desert Slopes. The physical conditions which characterize these slopes are pronounced slope exposure, large masses of rock *in situ*, and coarse soil limited to small benches, pockets, or fissures. The vegetation is similar to that of the Upper Bajada. *Prosopis*, *Parkinsonia*, and *Acacia* are represented by smaller and less frequent individuals, while *Carnegiea gigantea* is more abundant but consists of smaller individuals. *Fouquieria*, *Encelia*, and *Chrysoma laricifolia* are more abundant than on the Upper Bajada, and here are found for the first time *Vauquelinia californica*, *Agave palmeri*, and *Dasyilirion wheeleri* (Sotol).

The elevation of the different vegetational regions varies with the different mountains, as well as with different exposures on the same mountain. On the southern side of the Santa Catalinas, the Lower Desert Slopes usually lie between 3000 and 4000 feet, while the Upper Desert Slopes reach 5000 feet.

UPPER DESERT SLOPES

The Upper Desert Slopes are made distinctive by the entrance of certain plants of striking form, by the disappearance of the desert species, and by an abundance of perennial grasses, root perennials, small shrubs, and ephemeral plants, all of which help to form a much more complete ground-cover than is found on any parts of the Bajada. On these Upper Desert Slopes, *Vauquelinia* and *Dasyilirion* are common, and occur along with *Nolina microcarpa* (Bear Grass), *Arctostaphylos pungens* (Manzanita), *Agave schottii*, and *Yucca macracarpa*. Other species include *Bouteloua rothrockii* (Gramma Grass), *Muhlenbergia dumosa*, *Andropogon scoparium* (Beard Grass), *Eriogonum wrightii* (Umbrella Plant), *Dalea wislizeni*, and *Asclepias linifolia* (Milkweed).

ENCINAL REGION

Some of the characteristic plants of the Encinal Region are found as low as 4000 feet, while others go as high as 8000 to 8600 feet into the Forest Region. However, in general, the Lower Encinal may be said to begin at about 5000 feet on the south slopes of the mountains, and on the same side of the mountains, the Upper Encinal begins at about 5800 feet, and ends between 6200 and 6400 feet, where the Pine Forest starts.

LOWER ENCINAL

Open orchard-like stands of *Quercus oblongifolia* and *Quercus arizonica* mark the beginning of the Lower Encinal. Other common species at its desert edge are *Juniperus*, *Vauquelinia*, *Dasylyrion*, *Nolina*, *Yucca macrocarpa*, and *Agave palmeri*, all of which become more abundant farther up the mountains. The following plants appear only in the higher parts: *Quercus emoryi*, *Pinus cembroides* (Mexican Pinyon), *Garrya wrightii* (Silk Tassel), *Rhus trilobata* (Squaw Bush), and *Rhamnus crocea* (Red-berry).

UPPER ENCINAL

The chief difference between the Upper and the Lower Encinal is the gradual increase in density of stand of the evergreen trees and shrubs. True Upper Encinal is a dense thicket of trees 18 to 30 feet high. *Quercus emoryi* and *Quercus arizonica* are still the dominant trees, and the most common shrubs are *Arctostaphylos pungens*, *Garrya wrightii*, and *Mimosa biuncifera*. Semi-desert species and cactuses are infrequent. In places, *Pinus cembroides* forms almost pure stands, and here appear the first individuals of *Quercus reticulata*, *Pinus chihuahuana* (Chihuahuana Pine), and *Arbutus arizonica*.

FOREST REGION

FINE FOREST

The transition from Upper Encinal to Pine Forest is one of the most striking changes on the mountains. In the Santa Catalinas, it occurs between 5800 and 6000 feet on north slopes, and 6000 to 6400 feet on south slopes. Here the dense oak thickets give way to open forests of

Pinus arizonica (Arizona Yellow Pine), which attains a height of fifty to sixty feet. Throughout the Pine Forest, certain species occur which are also present in the Encinal, but it is only on the lowest edge of the Pine Forest that any genera characteristic of the Desert Region are found. The three to be noted are *Echinocereus polycanthos* (Hedgehog Cereus), *Yucca*, and an *Agave*. Characteristic trees are *Arbutus arizonica*, *Pseudotsuga mucronata* (Douglas Fir), *Pinus strobiformis* (Mexican White Pine), *Juglans rupestris*, *Prunus virens*, *Acer interior*, and *Alnus acuminata*. Some of the most conspicuous plants of the forest floor are *Ceanothus fendleri*, *Muhlenbergia virescens* (Bunch Grass), *Houstonia wrightii*, *Erigeron neomexicanus*, *Pteris aquilina* (Brake Fern), *Castilleja gloriosa*, and *Solidago bigelovii* (Golden Rod).

FIR FOREST

The transition from Pine to Fir Forest is not as abrupt or evident as that from the Upper Encinal to the Pine Forest. Nevertheless, the Fir Forest is found on all mountains which reach sufficient altitude. On the Santa Catalinas, this altitude is about 7500 feet on north slopes, but these mountains are not of sufficient height to bring the Fir Forest on southern exposures. The first indicators are the increasing numbers of *Pseudotsuga mucronata* and *Pinus strobiformis*, and the appearance of *Abies concolor* (White Fir). *Pinus arizonica* becomes more and more infrequent, and *Pinus strobiformis* is no longer confined to streams, but becomes mingled with *Pseudotsuga* and *Abies*. In the Fir Forest, the last relics of the Encinal have disappeared. *Quercus submollis* and *Populus tremuloides* are the most common subordinate trees, and frequently become dominant over areas of an acre or more in extent. Dense shade, heavy litter, and high humus content of the soil are characteristic conditions of the forest floor. These conditions are much different from those of the floors of any of the lower regions, and they combine to produce a very different type of undergrowth. In the densest stands, shrubs and herbaceous plants are not as abundant as in the Pine Forest. However, along streams, on open flood plains, and on dry ridges, slightly different environments occur, which bring variety into the Fir Forest. A few of the characteristic species are *Jamesia americana*, *Symphoricarpos oreophilus*, *Ribes pinetorum*, *Alnus acuminata*, *Acer interior*, *Salix exigua*, *Hypericum formosum*, *Osmorrhiza nuda*, *Oxalis metcalfeii*, and *Galium asperrimum*.

CHECK-LIST OF MAMMALS TREATED IN THIS REPORT*

1. *Sorex vagrans monticola* Merriam
2. *Nycteris borealis teliotis* (H. Allen)
3. *Spilogale gracilis gracilis* Merriam
4. *Mephitis estor* Merriam
5. *Taxidea taxus berlandieri* (Baird)
6. *Otospermophilus grammurus grammurus* (Say)
7. *Citellus tereticaudus neglectus* (Merriam)
8. *Ammospermophilus harrisi harrisi* (Audubon and Bachman)
9. *Eutamias dorsalis dorsalis* (Baird)
10. *Sciurus arizonensis catalinæ* Doult
11. *Thomomys fulvus intermedius* Mearns
12. *Perognathus baileyi baileyi* Merriam
13. *Perognathus penicillatus pricei* (Allen)
14. *Dipodomys spectabilis spectabilis* Merriam
15. *Dipodomys merriami merriami* Mearns
16. *Peromyscus maniculatus rufinus* (Merriam)
17. *Peromyscus boylei rowleyi* (Allen)
18. *Neotoma albigula albigula* Hartley
19. *Neotoma mexicana bullata* Merriam
20. *Neotoma lepida stephensi* (Goldman)
21. *Erethizon epixanthum couesi* Mearns
22. *Lepus alleni alleni* Mearns
23. *Lepus californicus eremicus* (Allen)
24. *Sylvilagus audubonii arizonæ* (Allen)
25. *Pecari angulatus sonoriensis* (Mearns)

MAMMALS OBSERVED OR REPORTED BUT OF WHICH NO
SPECIMENS WERE OBTAINED

26. Kit Fox: *Vulpes macrotis neomexicana* Merriam
27. Coyote: *Canis mearnsi* Merriam
28. Mountain Lion: *Felis concolor azteca* (Merriam)
29. Deer: *Odocoileus couesi* (Coues and Yarrow)

*Since this paper was written, articles dealing with the mammals of the region have been published by W. H. Burt; E. R. Hall; L. M. Huey; and E. A. Goldman.

PLAN OF TREATMENT

In the following list, an account is presented of each species of mammal collected. The scientific name is given first, and then an accepted common name. Following this, reference is made to the various accounts which deal with the species in southeastern Arizona. For convenience, reference is also made to Miller's list (Miller, 1924). The statement of material is restricted to those specimens collected by the author.

In the itinerary, each locality at which collections were made is listed, and is followed by a statement as to the vegetational area (life zone) in which it is located. Thus the vegetational region in which any specimen was taken can be determined by referring to the given locality in the itinerary.

ANNOTATED LIST OF THE MAMMALS COLLECTED

1. *Sorex vagrans monticola* Merriam

ROCKY MOUNTAIN SHREW

Sorex vagrans monticola, Miller (1924, p. 20); Jackson (1928, p. 110).

Material.—1 ad. female, Aug. 31, near Soldier Camp, Santa Catalina Mountains.

Remarks.—The single specimen of *Sorex* was caught near the edge of a small reservoir only after the *Peromyscus* had been reduced in numbers.

2. *Nycteris borealis teliotis* (H. Allen)

WESTERN RED BAT

Lasiurus borealis teliotis, Miller (1897, p. 110).

Nycteris borealis teliotis, H. W. Grinnell (1918, p. 323); Miller (1924, p. 79).

Material.—4 specimens: 1 ad. female, 1 im. male, 2 im. females, Aug. 10, Tucson.

Remarks.—The ranges of *N. b. teliotis* and *N. b. borealis* might be expected to meet somewhere in the vicinity of Tucson. The single adult female from Tucson is not typical of either race. Allen lists an adult female (subspecies undetermined) with two nursing young from the Chiricahua Mountains, 95 miles southeast of Tucson (see *Atalapha borealis*, Allen, 1895, p. 246). The present specimens and also those listed by Allen were roosting in a peach tree.

3. *Spilogale gracilis gracilis* Merriam
CANYON SPOTTED SKUNK

Spilogale gracilis, Allen (1895, p. 252); Howell (1906, p. 22).

Spilogale gracilis gracilis, Miller (1924, p. 133).

Material.—7 specimens: 1 ad. female nursing, July 8, Florida Canyon, Santa Rita Mountains; 1 ad. male and 2 im. females, Aug. 5 and 6, mouth of Soldier Canyon, Santa Catalina Mountains; 1 ad. male and 1 im. female, Aug. 29 and 30, near Soldier Camp, Santa Catalina Mountains; 1 im. male, Aug. 30, near Stratton Mine, Santa Catalina Mountains.

Remarks.—These specimens were identified by Dr. A. H. Howell. We found the species ranging from Upper Bajada at 3000 feet to Fir Forest at 8000 feet, or a total altitudinal range of 5000 feet. They were very common both at Soldier Canyon and at Soldier Camp.

It was so late when we found a camping spot in Florida Canyon that we had to make camp at once, so I strung, on a line outside the tent, three Jack Rabbits I had collected. Under them, I set three steel traps, which were not fastened. The next morning one of the traps was gone, but shortly the clink of the trap chain against a rock led me to the place where an adult female spotted skunk was hiding. By careful manipulation, it was possible to drain out all the contents from the scent glands, and after that the animal was practically harmless. It was kept about camp for several days, and although it did not become tame, we were able to approach without causing it to assume the normal defense attitude. In fact, with care we were able to handle and pet the skunk.

4. *Mephitis estor* Merriam
ARIZONA SKUNK

Chincha estor, Howell (1901, p. 32).

Mephitis estor, Allen (1895, p. 250); Grinnell (1914, p. 257); Swarth (1929, p. 347).

Material.—3 specimens: 1 im. male, July 29, Pinal Peak, Pinal Mountains; 1 im. female, and 1 skull only, Aug. 27, near Soldier Camp, Santa Catalina Mountains.

Remarks.—*Mephitis* and *Spilogale* were both found in the vicinity of Soldier Camp. *Spilogale* occurred both on the tops of the mountains and at the mouths of canyons near the desert floor. *Mephitis*, however, was collected only on the tops of the mountains.

The female taken near Soldier Camp was caught in a steel trap. When I approached it, it made no attempt at defense, merely looked up, took notice of me, and then huddled down over the trap again. I was able to approach within a few feet to take a photograph without disturbing it.

5. *Taxidea taxus berlandieri* (Baird)

MEXICAN BADGER

Taxidea taxus berlandieri, Allen (1895, p. 256); Grinnell (1914, p. 259); Miller (1924, p. 142).

Material.—1 im. male, July 21, Peppersauce Canyon, Santa Catalina Mountains.

Comparisons.—Very similar in color to specimens from southern and eastern California, and central Nevada. Specimens from northern and western California are slightly more Tawny Olive.

Remarks.—The specimen is of a young male about half grown. When first observed, it was walking leisurely down a ditch beside the road, apparently unaware of the approach of a noisy automobile. When pursued, it attempted to escape, but was easily overtaken. As soon as it saw that it could not evade me, it turned, and with ferocity, assumed an offensive attitude; only after some difficulty was it captured and put into a wooden box. This, however, proved to be a poor cage, for with its long claws and sharp teeth it soon made a hole in it that was almost large enough for escape.

After several days, it became much more docile but never very friendly, and we always touched it with a certain amount of caution. Occasionally it was turned loose in a large field, and invariably it attempted to escape by running away or by digging. If given opportunity, it could bury itself in the ground in a very few minutes. As it dug, an almost continual stream of earth was forced into the air by its hind feet, and by the time the front half of its body was beneath the ground, it was almost impossible to pull it out.

6. *Otospermophilus grammurus grammurus* (Say)

COLORADO ROCK SQUIRREL

Anisonyx (*Otospermophilus*) *grammurus*, Allen (1895, p. 237).

Otospermophilus grammurus, Mearns (1907, p. 315).

Otospermophilus grammurus grammurus, Miller (1924, p. 180); Swarth (1929, p. 348).

Material.—7 specimens: 1 ad. male, July 14, Old Baldy Peak, Santa Rita Mountains; 1 im. female, Aug. 2, 1 ad. male and 1 ad. female, Aug. 16, Desert Laboratory, Tucson; 1 ad. female, Aug. 5, mouth of Soldier Canyon, Santa Catalina Mountains; 2 ad. males, Aug. 25 and 30, near Soldier Camp, Santa Catalina Mountains.

Comparisons.—These specimens differ from the description of *Otospermophilus grammurus* given by Mearns (1907, p. 315) only in the following details:

1. Top of head and ears not much mixed with black.
2. Orbital circle white, not yellowish white.
3. Total length averages 12 to 21 mm. less.

A specimen in the Museum of Vertebrate Zoology collection from northeast of San Francisco Mountain, when compared with specimens from south of the Salt River, shows a darker, more red rump patch. In this respect it is more like a young female from Colorado Springs, Colorado. This latter specimen is nearer to the type locality of *Otospermophilus grammurus grammurus* than any other specimen which I have. Compared with specimens from south of the Salt River, its rump patch is decidedly redder, and it extends farther towards the head; the shoulders are not so gray, but are mixed with a little more brown. In general, specimens from south of the Salt River appear to have a lighter, that is, a more yellow and less red rump patch than specimens to the northward.

Remarks.—Rock Squirrels were found throughout the region in which we collected, wherever suitable habitats occurred. They ranged in altitude from 2400 to 9400 feet. At the lower elevations, they were found in rocky canyons, and on the mountains, in the neighborhood of cliffs and rock piles. Though they were seldom seen in trees, they could readily climb when the occasion demanded it. They were often found in the same habitat as *Spilogale*; a trap set in the same place for two consecutive days caught a Rock Squirrel one day and a Spotted Skunk the next. A young female about half grown was taken on August second, and others of the same size were seen at the time.

The female taken near the mouth of Soldier Canyon was kept alive for two days; it had been caught in a steel trap by one foot but was not seriously injured. When placed in the same cage with a Gila Monster, it immediately showed great fear, and kept as far from the Gila Monster as the cage would permit, frequently uttering a high-pitched jerky whistle. Late the next afternoon, it was found lying

unconscious on the floor of the cage. Aromatic spirits of ammonia revived it slightly, but it died that evening. Presumably, a bite from the Gila Monster caused its death; the Gila Monster was unharmed.

7. *Citellus tereticaudus neglectus* (Merriam)

DOLANS SPRING GROUND SQUIRREL

- Spermophilus neglectus* Merriam (1889, p. 17).
Anisonyx (Ictidomys) tereticaudus, Allen (1895, p. 238).
Citellus tereticaudus, Mearns (1907, p. 336).
Citellus tereticaudus tereticaudus, Grinnell (1914, p. 224), part.
Citellus tereticaudus arizonæ Grinnell (1918, p. 105).
Citellus neglectus, Miller (1924, p. 189).
Citellus tereticaudus neglectus, Swarth (1929, p. 349).

Material.—7 specimens: 1 ad. female, July 26, 10 mi. south of Florence; 3 ad. males, 3 ad. females, Aug. 5-11, mouth of Soldier Canyon, Santa Catalina Mountains.

Remarks.—*Citellus tereticaudus arizonæ* is synonymized with *Citellus neglectus* for the following reasons: The original description of *neglectus* mentions the two essential features that differentiate *C. neglectus* and *C. t. tereticaudus*. Furthermore, the author makes it clear that *neglectus* is more closely related to the species *tereticaudus* than to any other species. Grinnell (1914, p. 224), in his Colorado River survey, demonstrates that the specimens of *Citellus* from the Arizona side of the river are distinct from those on the California side; thus the subspecies *tereticaudus* is restricted to the California side of the river. Grinnell (1918, pp. 105-106) shows that the specimens of *Citellus tereticaudus* from Arizona are easily distinguishable from *eremonomus*, *chlorus*, and *tereticaudus*, the three known subspecies of *Citellus tereticaudus*. However, he does not mention *neglectus*, which was described from northwestern Arizona. It is clear, therefore, that specimens of *Citellus tereticaudus* from Arizona should be referred either to *arizonæ* or to *neglectus*. Careful comparison of the original descriptions reveals little difference between the two forms. Each author compares the specimens he is describing with *C. t. tereticaudus*. The two most important characters given by each author are color of the upper parts and length of the tail. Both state that the tail is noticeably shorter in Arizona-taken animals than that of *C. t. tereticaudus*. Grinnell, using Ridgway (1912) as a standard for color nomenclature, says of the upper parts: "On back, top of head and tail, deep pinkish cinnamon, becoming paler on neck, shoulders and sides,

due to the greater extent of the minute white tipplings to the hairs." Merriam describes the color of the upper parts as follows: "Above, grizzled grayish brown, resulting from the intimate and very fine admixture of white and black tipped hairs over a cinnamon ground color." Some time after the description of *arizonæ*, Dr. Grinnell had an opportunity to examine the type of *neglectus*, and he found that it was not distinct from specimens which he had previously called *arizonæ*. Therefore, it must stand as a synonym of *neglectus*, which antedates *arizonæ* by more than a quarter of a century.

In spite of the fact that it is necessary to regard *neglectus* and *arizonæ* as synonyms, there is a great deal of variation in skin measurements of different local groups. For instance, an adult male specimen collected near Tucson, Arizona, measured: total length 248, tail 89, hind foot 37 mm.; five adults from the mouth of Soldier Canyon averaged 240, 80.2, 31.2 mm. (measurements in same order as above); and a specimen from ten miles south of Florence measured 221, 70, 35 mm. This last specimen, though fully adult, and with a perfect tail, was very small both in skin and skull measurements; in color it was more cinnamon than any individual from the mouth of Soldier Canyon. The table given by Mearns (1907, p. 338) shows a gradual increase in tail length as one progresses from the vicinity of Phoenix and New River to the Mexican boundary, and thence westward to the vicinity of Seven Wells, Lower California.

There is an interesting parallel between *Ammospermophilus harrisi harrisi* and this species of *Citellus*. Both are desert rodents with a short summer coat, and in both the skin on the dorsal surface is very heavily pigmented. Other diurnal desert rodents, such as *Lepus californicus eremicus* and *Lepus alleni alleni*, which have a heavy coat of fur throughout the summer, lack the pigment in the skin. Perhaps the pigment is correlated with the slight protection given by the very thin summer coat, and serves to protect the animal from the intense sunlight. It would be interesting to see if such a relation holds in other mammals.

8. *Ammospermophilus harrisi harrisi* (Audubon and Bachman)

HARRIS GROUND SQUIRREL

Anisonyx (*Ammospermophilus*) *harrisi*, Allen (1895, p. 240).

Ammospermophilus harrisi, Mearns (1907, p. 303); Swarth (1929 p. 349).

Ammospermophilus harrisi harrisi, Grinnell (1914, p. 219).

Ammospermophilus harrisi harrisi, Miller (1924, p. 195).

Material.—9 specimens: 4 ad. females, July 6-10, Florida Canyon, Santa Rita Mountains; 1 ad. female, 1 ad. male, 2 skull only, Aug. 4-16, mouth of Soldier Canyon, Santa Catalina Mountains.

Remarks.—Both Grinnell (1914, p. 221) and Swarth (1929, p. 351) state that specimens of *Ammospermophilus* from the east side of the Colorado River do not bear out Mearns' (1896, p. 444, and 1907, p. 306) description of *A. h. saxicola*, and they discard the latter name as synonymous with *harrisii*. However, I believe *saxicola* will bear further consideration. During this study, only one topotype of *saxicola* was available. Although probably mature, it is a young individual. Little difference can be detected in color between it and specimens of *harrisii* in the Museum of Vertebrate Zoology collection from the east side of the Colorado River. However, two individuals of *harrisii* from the Colorado River which were comparable in age with the specimen of *saxicola* have a tail to body ratio of 54 and 48.3 respectively, and one specimen of *harrisii* from the vicinity of Tucson has a tail to body ratio of 52.4, while the specimen from Tinajas Altas, the type locality of *saxicola*, has a tail to body ratio of 57.5. Of the available specimens of *harrisii*, these three are most similar to the specimen of *saxicola* in the above measurements. Young individuals have a much greater tail to body ratio than old individuals from the same locality, and so the above specimens were selected because they were of comparable age. In the table of measurements given by Mearns (1907, pp. 307-309), thirty-two specimens of *A. h. harrisii* have an average total length of 235 and a tail length of 80.3, which makes a tail to body ratio of 52; fifteen specimens of *A. h. saxicola* have an average total length of 234 and tail length of 86.6, which makes a tail to body ratio of 59. *Saxicola* also shows slight differences in skull measurements as indicated in the following table:

TABLE I

	Occipito-nasal length	Zygomatic width
Topotype of <i>saxicola</i>	36.5	21.1
Specimen from E. side Colorado River.....	38.3	22
Specimen from Tucson.....	40.3	23

Again these individuals were selected because they were of comparable age; they also proved to approach *saxicola* most closely in these measurements. The average measurements given by Grinnell (1914, p. 220) for twenty-four adults from the Arizona side of the Colorado

River, followed in parenthesis by the average of five adults from Florida Canyon and the mouth of Soldier Canyon are as follows: occipito-nasal length of skull 39.3 (40.7); zygomatic width 22.7 (23.2).

Specimens from the Colorado River region should not be taken to represent *saxicola*, for although Mearns (1907, p. 303) says, "In the desert ranges bordering the lower Colorado River it [*Ammospermophilus harrisi*] is represented by the subspecies *saxicola*," this is not a clear statement of his idea of its range as is indicated on page 306 (*op. cit.*), where he defines its range more accurately as follows: "This [*Ammospermophilus harrisi saxicola*] is a long-tailed, pallid, desert race, inhabiting bare granite ranges of mountains, extending in a southeasterly direction from the Gila River, in southwestern Arizona (Yuma County), into western Sonora." From the first statement, one would be led to believe that *saxicola* is to be found along the Colorado River, but as he defines the range of this subspecies, it does not reach the Colorado River at all, and further, on page 307 (*op. cit.*) he says, "none were observed along the lower course of the Colorado River." It therefore appears that *saxicola* occurs south of the Gila River and ranges in a north-south rather than in an east-west direction. Thus specimens from the Colorado River would not represent *saxicola*, and I believe more topotypes should be examined before the subspecies is discarded.

Ammospermophilus harrisi harrisi presents some interesting problems in geographic distribution. Mearns (1907, p. 303) says that Arizona is its center of abundance, but that it extends into California, Nevada, Utah, New Mexico, and Mexico. From Grinnell's Colorado River survey (Grinnell, 1914), however, it is evident that *A. h. harrisi* is restricted to the Arizona side of the lower Colorado River, and thus does not extend into California. Mearns (1907, p. 304) has recorded specimens of *A. h. harrisi* from "the deep canyon of the Colorado" and the tributary canyon of Cataract Creek, which is a branch of Havasu Creek. This latter locality lies between the type localities of *A. leucurus cinnamomeus* and that of *A. l. tersus*, recently described by Goldman (1929, p. 435) from the lower end of Prospect Valley, Grand Canyon, Hualpai Indian Reservation, 4500 feet. This small colony of *harrisi* would thus appear to be surrounded by *leucurus*, or else *harrisi* ranges over the northern part of the Coconino Plateau at a greater elevation than 6000 feet, which I believe is al-

most 800 to 1000 feet higher than it is known to occur. Mearns (1907, p. 303) gives its limit as being below 5200 feet. Further examination of this colony of *harrisii* should prove very interesting. I have no record of *A. h. harrisii* from north of the Mogollon Plateau nor anywhere above the 6000 foot contour line extending northward to the Colorado River. Thus *harrisii* in Arizona seems to be confined south and west of this 6000 foot contour line, which extends roughly from Clifton in the southeast section of the state to Grand Wash Cliffs in the northwest part of the state. Further, both Swarth (1929, p. 349) and Mearns (1907, p. 305) comment on the absence of *harrisii* in the extreme southeastern section of the state, from the Pajaritos and Santa Rita mountains eastward. Between Ft. Bowie and the Mogollon Plateau, however, Swarth (*loc. cit.*) states that it extends into New Mexico.

One individual of *A. h. harrisii* was seen feeding at a pile of horse dung. Upon examination, it was found that the dung contained many undigested Mesquite seeds, and these, no doubt, were what the squirrel had been eating. The burrows of these animals are usually under a desert shrub such as a Palo Verde, Mesquite, or Cresote Bush, but sometimes they are in the open. The animals are active during the hottest part of the day, but I have never seen them at night, although I have been hunting at all hours between sunset and sunrise. I have watched these animals when they were apparently unaware of my presence, running about the desert floor, and stopping frequently to dig up something from the ground in a fashion similar to that of the eastern Gray Squirrel. The shallow holes which they thus leave are frequently very evident signs of their presence.

9. *Eutamias dorsalis dorsalis* (Baird)

CLIFF CHIPMUNK

Tamias dorsalis, Allen (1895, p. 241).

Eutamias dorsalis, Mearns (1907, p. 288).

Eutamias dorsalis dorsalis, Miller (1924, p. 208); Howell (1929, p. 131).

Material.—5 specimens: 1 ad. and 2 im. males, Aug. 17, 2 im. females, Aug. 25, near Soldier Camp, Santa Catalina Mountains.

Remarks.—*E. d. dorsalis* was found only in the Pine and Fir Forest near Soldier Camp. On August 28, they were noted as being the most common diurnal mammal. They were notably inquisitive, and al-

though the slightest motion would frighten them into hiding, they were soon out again to observe the intruder, or to continue their search for food. One of the specimens was shot as it was eating the meat with which I had baited a steel trap. Though the species was abundant in the Santa Catalinas, it was not observed in the Santa Ritas; and both Allen (1895, p. 243) and Mearns (1907, p. 290) comment on its absence from the Huachuca Mountains.

10. *Sciurus arizonensis catalinæ* Doult

CATALINA MOUNTAIN GRAY SQUIRREL

Sciurus arizonensis catalinæ Doult 1931, p. 271.

Material.—6 specimens: 1 ad. male, 4 ad. females, Aug. 17-30, near Soldier Camp, Santa Catalina Mountains; 1 ad. female, July 14, Santa Rita Mountains.

Remarks.—The following comparisons and remarks are taken from the original description (Doult 1931).

Comparisons.—This new race comes from a region that lies between the range of *S. a. arizonensis*, which occurs to the northward, and that of *S. a. huachuca*, which occurs to the southward; and, as might be expected, it shows characters which are intermediate between the two subspecies. The intermediate character of specimens from this region was noted also by Mearns (1907, p. 280) and by Nelson (1899, p. 97). As compared with *huachuca*, *catalinæ* is Russet instead of Deep Mouse Gray over the rump region; rostrum relatively as well as actually narrower and shallower; interorbital breadth greater; height of braincase less. As compared with *arizonensis*, *catalinæ* has the brown markings confined to the rump region instead of extended continuously from the head to the base of the tail; rump region Russet rather than Tawny Olive; shoulder region Pale Mouse Gray rather than Tawny Olive; interorbital breadth tending to be greater, and height of braincase less.

Remarks.—The series of *S. a. arizonensis* clearly shows that there is a decided seasonal variation in color similar to that mentioned by Mearns (1907, p. 279) in regard to *S. a. huachuca*; similar variation may be expected also in *S. a. catalinæ*.

The specimen from the Santa Rita Mountains, although most similar to *S. a. catalinæ*, can be separated readily from any of the other five specimens by its more Rufous crown patch. In the series of seventeen

skins of the species here assembled, it is interesting to note that specimens to the south are grayest, and that northward there is a gradual increase of Rufous or Tawny Olive.

At the time the author was in the Santa Catalina Mountains, these squirrels were feeding on the seeds of White Pine cones, and in this connection the following digest from the field journal may be of interest. On the morning of August 24, I was hunting along the ridge south of Soldier Camp, and having previously seen signs of squirrels working along the ridge, was on the lookout for them. About five hundred yards from camp I shot one out of a White Pine tree, and just a little later saw two others in another White Pine tree. I watched one of these go out to the end of a branch and gnaw off a cone. Instead of letting the cone fall to the ground and going there to eat it, it carried the cone part way back along the branch and there, balancing itself on its hind feet, it held the cone between its front feet and the branch. As it ate the seeds it turned the cone around on the branch with much dexterity. The cones at this time were covered with soft resin and the squirrels became smeared with this, especially on the paws and about the mouth, thus causing the fur there to become badly matted.

11. *Thomomys fulvus intermedius* Mearns*

MOUNTAIN-TOP POCKET GOPHER

Thomomys fulvus, Allen (1895, p. 205), part.

Thomomys fulvus intermedius, Bailey (1915, p. 84); Miller (1924, p. 245); Swarth (1929, p. 351).

Material.—1 ad. female, Aug. 31, near Soldier Camp, Santa Catalina Mountains.

Remarks.—The single specimen obtained does not have the broad dorsal area of plumbeous black extending from the nose to the rump which Mearns mentions in the original description. Unfortunately the skull is badly broken. Workings of *Thomomys* were found on the Santa Catalina Mountains between 7000 and 8000 feet. Workings were also noted on the Pinal Mountains at 7800 feet, but no specimens were obtained.

*Since this paper was written, Goldman (1931, p. 419) has described the Pocket Gopher from the Santa Catalina Mountains as a new sub-species, *T. f. catalinae*.

12. *Perognathus baileyi baileyi* Merriam
BAILEY POCKET MOUSE

Perognathus baileyi, Osgood (1900, p. 41).

Perognathus baileyi baileyi, Miller (1924, p. 280); Swarth (1929, p. 355).

Material.—2 specimens: 1 ad. male, July 7, Florida Canyon, Santa Rita Mountains; 1 ad. female, Aug. 5, Soldier Canyon, Santa Catalina Mountains.

Remarks.—No specimens of this species are recorded by Allen (1895), and the westernmost specimens listed by Osgood (1900, p. 42) are one from Mammoth, Pinal County, and one from the Santa Catalina Mountains. Swarth (1929, p. 355) lists 25 specimens, and comments on the fact that they were all from the west side of the Santa Rita Mountains. Apparently, then, the Mexican Highland Section forms their eastern limit in this region.

13. *Perognathus penicillatus pricei* (Allen)
PRICE POCKET MOUSE

Perognathus obscurus, Allen (1895, p. 216).

Perognathus penicillatus pricei, Osgood (1900, p. 47); Miller (1924, p. 282); Swarth (1929, p. 355).

Material.—2 specimens: 1 ad. female, July 26, 10 mi. south of Florence; 1 ad. male, July 29, 10 mi. north of Florence.

Remarks.—In 1894, W. W. Price, in speaking of this species, stated that it was the most common pocket mouse south of the Mogollon Mesa, outnumbering all other kinds three to one. That only two are represented in this collection is probably due to the fact that we spent very little time in its typical habitat.

14. *Dipodomys spectabilis spectabilis* Merriam
LARGE KANGAROO RAT

Dipodomys spectabilis, Allen (1895, p. 212).

Dipodomys spectabilis spectabilis, Vorhies and Taylor (1922); Miller (1924, p. 290); Swarth (1929, p. 356).

Material.—1 specimen, Sept. 4, between Florence and Tucson along U. S. Highway 80.

Remarks.—The only specimen of this species which was obtained was a badly mangled one found crushed on the highway. Although

their workings were abundant in many places, especially on the desert below Florida Canyon, Santa Rita Mountains, yet they successfully evaded all traps placed for them. Price (*see* Allen, 1895, p. 213) also comments on the difficulty of catching them with baited traps, but states they were easily caught in steel traps.

15. *Dipodomys merriami merriami* Mearns

MERRIAM KANGAROO RAT

Dipodomys merriami, Allen (1895, p. 213).

Dipodomys merriami merriami, Grinnell (1914, p. 241, and 1922, p. 73); Miller (1924, p. 291); Swarth (1929, p. 356).

Material.—6 specimens: 1 ad. male, July 11, Florida Canyon, Santa Rita Mountains; 1 ad. male, July 26, 10 mi. south of Florence; 3 ad. females, 1 ad. male, Aug. 4-6, Soldier Canyon, Santa Catalina Mountains.

Remarks.—Kangaroo rats were one of the most common nocturnal animals on the desert. They were found in the same general habitat that *Ammospermophilus harrisi* frequented during the day. At night, these animals were not at all frightened by a light, and I could approach within a few feet to watch them search the desert floor for food. They usually hopped rapidly over open spaces, but stopped to examine carefully the ground under each bush or shrub. Seeds which they found were not eaten on the spot, but were put into their cheek pouches.

16. *Peromyscus maniculatus rufinus* (Merriam)

TAWNY WHITE-FOOTED MOUSE

Peromyscus leucopus rufinus, Allen (1895, p. 232).

Peromyscus sonoriensis rufinus, Mearns (1907, p. 391).

Peromyscus maniculatus rufinus, Osgood (1909, p. 72); Miller (1924, p. 328).

Material.—4 specimens: 2 ad. males and 2 ad. females, Aug. 24-26, near Soldier Camp, Santa Catalina Mountains.

Comparisons.—Compared with the description of *rufinus* given by Osgood (1909, p. 72), these specimens differ as follows:

1. Upper parts Drab to Hair Brown rather than Ochraceous or Tawny Ochraceous.

2. Subauricular tufts not conspicuous.

3. Underparts bluish white rather than creamy white. Compared with topotypes of *rufinus*, the Santa Catalina specimens are much

darker, with sides grayer; rostrum of skull broader and heavier; brain-case more rounded; palate wider.

Remarks.—All of these specimens were caught in the Pine and Fir zones on the north slope of the Santa Catalina Mountains. They are uniformly so much darker than the topotypes of *rufinus* that for a time it was suspected that they might represent a new race. Very recently, however, another specimen from the same locality has been added to the collection of the Museum of Vertebrate Zoology. It is so much more like *rufinus* that it throws grave doubts upon the advisability of recognizing the animals from the Santa Catalinas as a new form. At the present time, therefore, it seems prudent to refer these specimens to *rufinus* until a larger series can be obtained.

From the evidence at hand, there seems to be a difference in color which corresponds to a difference in geographic area. Allen (1895, p. 232) records a series of 182 specimens from the White, Graham, and Chiricahua mountains. The White Mountains rise from the Mogollon Mesa just as the San Francisco Mountains do, and Allen (*loc. cit.*, p. 233) states that "The White Mountain series seems not to differ appreciably from specimens of *rufinus* from the San Francisco Mountains, the type locality of the subspecies." He had 68 specimens from the White Mountains. The Graham, Chiricahua, and Santa Catalina mountains, on the other hand, all belong to the Mexican Highland Section, and rise out of desert plains. Allen had 25 specimens from the Graham Mountains, and commented on their "broad blackish dorsal area," and the "paler and more mixed with blackish" rump and sides as compared with the White Mountain series. He added, further, that he had two specimens from the same locality which showed remnants of a tawny red pelage, and so he concluded that the color of the majority of his specimens was a seasonal feature. The series of 89 from the Chiricahua Mountains, he stated was quite similar to the Graham Mountain series. The present specimens from the Santa Catalina Mountains also appear to be more like the Graham Mountain series than like *rufinus* from San Francisco Mountain, the type locality.

Thus it is seen, that specimens coming from mountain peaks in the Mexican Highland are darker than specimens from the mountains which rise from the Mogollon Mesa. However, for the revision of the genus, Osgood had specimens from all the above localities except the Santa Catalina Mountains, yet he does not mention this difference in color. Further study should be made of a large series from this region.

17. **Peromyscus boylii rowleyi** (Allen)

ROWLEY WHITE-FOOTED MOUSE

Peromyscus rowleyi, Allen (1895, p. 227).

Peromyscus boylii pinalis, Mearns (1907, p. 416).

Peromyscus boylei rowleyi, Osgood (1909, p. 145).

Peromyscus boylii rowleyi, Miller (1924, p. 339); Swarth (1929, p. 363).

Material.—8 specimens: 1 ad. female, July 11, Florida Canyon, Santa Rita Mountains; 1 ad. male and 1 ad. female, July 14, Old Baldy Peak, Santa Rita Mountains; 2 ad. males and 1 im. female, Aug. 26 and 30, near Soldier Camp, Santa Catalina Mountains; 2 ad. females, July 29, Pinal Peak, Pinal Mountains.

Remarks.—*P. b. rowleyi* was found on all the mountains visited, ranging from the Lower Encinal to the Fir Forest, but it was not found below the Lower Encinal. The altitudinal range noted above is from 4200 to 8450 feet.

One of the specimens collected was shot from an oak tree on a moonlight night; it was climbing about on the branches twenty feet above the ground.

18. **Neotoma albigula albigula** Hartley

WHITE-THROATED WOOD RAT

Neotoma albigula, Mearns (1907, p. 476); Goldman (1910, p. 31).

Neotoma albigula albigula, Miller (1924, p. 378); Swarth (1929, p. 364).

Material.—9 specimens: 1 ad. female, nursing, July 9, 1 im. female, July 11, Florida Canyon, Santa Rita Mountains; 4 ad. males and 3 ad. females, Aug. 16 and 19, near Desert Laboratory, Tucson.

Remarks.—These were abundant near the Desert Laboratory, at Florida Canyon, and along the U. S. highway, 10 miles south of Florence, but none was found at the higher altitudes in the mountains.

19. **Neotoma mexicana bullata** Merriam

SANTA CATALINA MOUNTAIN WOOD RAT

Neotoma mexicana bullata, Mearns (1907, p. 491); Goldman (1910, p. 59); Miller (1924, p. 384).

Material.—3 specimens: 1 ad. male, 1 ad. female, 1 im. female, Aug. 24-29, near Soldier Camp, Santa Catalina Mountains.

Remarks.—*N. m. bullata* is apparently a rather rare form. Goldman had only one, the type, in his revision of the genus *Neotoma*. Mearns

listed seven from the Huachuca Mountains and one from the San Luis Mountains, but Goldman evidently considered that these represented some other form. While we were collecting near Soldier Camp, they were not abundant, only three specimens being taken. They were all caught near a rock ledge in Fir Forest.

20. **Neotoma lepida stephensi** (Goldman)

STEPHENS WOOD RAT

Neotoma stephensi, Mearns (1907, p. 493).

Neotoma lepida stephensi, Goldman (1910, p. 80); Miller (1924, p. 388).

Material.—1 ad. female, July 29, Pinal Peak, Pinal Mountains.

Remarks.—Specimens of the Stephens Wood Rat are apparently not very abundant in collections. Mearns had no specimens; he merely lists the species and gives the original description. He supposes it to be the form found in the Verde Mountains. Goldman, during his revision of the genus, had only 27 specimens. There are three in the Museum of Vertebrate Zoology collection from Deadman's Flat, San Francisco Mountain. As far as known, the present specimen from Pinal Peak is the most southern record of the species and extends its known range approximately 160 miles southward.

21. **Erethizon epixanthum couesi** Mearns

ARIZONA PORCUPINE

Erethizon epixanthus couesi Mearns (1897, p. 723).

Erethizon epixanthum couesi, Miller (1924, p. 437).

Material.—1 im. female, Aug. 15, 3 mi. northwest of Tucson.

Comparisons.—This specimen is a young individual, scarcely two-thirds grown. It is similar in color to specimens from near Flagstaff and San Francisco Mountain, Arizona. A specimen of about the same size, from Plumas County, California, is also similar to it in color; but two adults from Lassen and Tehama counties of northern California are much browner. A series from White Pine County, Nevada, shows color differences which are just as great as those between the specimens from Arizona and California mentioned above. With such variation in specimens from a single locality, it is impossible to decide, from the material at hand, whether *couesi* is a valid form or not.

Remarks.—This animal was found by the side of the road; it had been hit by an automobile, and its skull was badly crushed. Its

presence in the desert so far from any mountains where conditions favorable for its existence would occur, is unusual. If it actually were roaming about on the desert, it shows a remarkable ability to range over great distances and diverse conditions. There is a possibility, however, that the animal was brought from the mountains in somebody's automobile and then was lost or turned loose on the desert.

22. *Lepus alleni alleni* Mearns

ANTELOPE JACK RABBIT

Lepus alleni, Allen (1895, p. 201); Nelson (1909, p. 117).

Lepus alleni alleni, Miller (1924, p. 456); Swarth (1929, p. 364).

Material.—6 specimens: 1 ad. female, June 29, Quinlan Mountains; 1 ad. male, Aug. 11, mouth of Soldier Canyon, Santa Catalina Mountains; 4 ad. females, Aug. 20, near Oracle.

Remarks.—This species occurred throughout the Desert Region and was just as abundant as *Lepus californicus eremicus*.

23. *Lepus californicus eremicus* (Allen)

ARIZONA JACK RABBIT

Lepus texianus eremicus, Allen (1895, p. 202).

Lepus californicus eremicus, Nelson (1909, p. 140); Miller (1924, p. 459); Swarth (1929, p. 367).

Material.—7 specimens: 1 ad. male, Aug. 9, Cat Mountain, Tucson Mountains; 1 ad. male, Aug. 11, mouth of Soldier Canyon, Santa Catalina Mountains; 1 im. female, 1 ad. male, Aug. 19, Desert Laboratory, Tucson; 1 ad. male, Aug. 17, near Walnut, northwest base of the Santa Catalina Mountains; 1 ad. male and 1 ad. female, Aug. 20, near Oracle.

Remarks.—The single adult male from Soldier Canyon is not typical *eremicus*, and several of its characters suggest *texianus*, as described by Nelson (1909, p. 142). Compared with specimens of *eremicus* from near Tucson, it presents the following characters: back, sides, and ears grayer; rump almost white; tail short (80 mm.), and not so intense black; black on tips of ears not so intense nor so extensive; size large (total length 604 mm.). Such intergrades are not uncommon in New Mexico and eastern Arizona. This specimen is from a little farther southwest than any previous records.

Throughout the region where collections were made, *eremicus* was abundant in the Desert Region up to 4500 feet; above this it was less common, and did not occur in the Pine and Fir Forest on the Santa Catalina or Santa Rita mountains.

On the night of August 6, I caught a small female Jack Rabbit, which was probably several days old. This rabbit lived for eighteen days, and during that time the following observations were made. Although it was out of the nest and able to run very fast, it was still suckling. For two days it had no food. Then a goat was procured, and it drank greedily of warm goat's milk at the first feeding. Later it refused to drink more than four to six cubic centimeters of milk at a time, but wanted to be fed frequently, every hour or so. After five days, the rabbit began drinking fifteen to thirty cubic centimeters at a feeding, and was fed but three times a day. It seemed to prefer goat's milk to cow's, and warm milk to cold. On the sixth day after capture, it, for the first time, showed interest in grass blades, smelling at some in its cage. On August 19, it was observed to eat a few small lumps of sand, and again smelled at blades of grass, but ate none. It was not until August 20, fourteen days after capture, that it ate several blades of grass.

After eating, from the very first, the young rabbit always washed its paws and face as a cat does, this washing operation being preceded by a peculiar shaking of the paws, as if, perhaps, to shake sand from them. As it grew older, this shaking of the paws became more pronounced. On the sixth day, a nest was made in one corner of the cage, from grass which I had placed there. At this time it was quite tame, and liked to be petted on the head and liked to lick our arms, perhaps for salt from perspiration. The rabbit seemed to be affected by intense sunlight. On August 20, it was left in the direct sun for a short time, and soon appeared ill, quaked and shivered, and its sides heaved. When placed in the shade, however, it became normal again after a few minutes. On August 22, sixteen days after its capture, it was taken to camp in the Santa Catalina Mountains, at an elevation of 8000 feet. During the first night it seemed cold, although the nest was warm. The next day it was noticeably wilder, and in trying to escape me, fought and scratched. The second morning, it was found dead in its cage. Its stomach, when examined, appeared normal, and was half full of grass. Its death was probably due to the extreme change in conditions involved at this altitude.

24. *Sylvilagus audubonii arizonæ* (Allen)

ARIZONA COTTONTAIL

Lepus sylvaticus arizonæ, Allen (1895, p. 202).

Sylvilagus auduboni arizonæ, Nelson (1909, p. 222); Grinnell (1914, p. 250); Swarth (1929, p. 367).

Sylvilagus audubonii arizonæ, Miller (1924, p. 471).

Material.—5 specimens: 2 ad. females, 1 ad. male, Aug. 16 and 19, Desert Laboratory, Tucson; 1 ad. female, Aug. 20, near Oracle; 1 skull only, July 26, 10 mi. south of Florence.

Remarks.—This species was abundant in the Desert near Tucson and Oracle. One of the females taken near the Desert Laboratory on August 16, contained two embryos. Its pelage was much more worn than others taken at the same time.

25. *Pecari angulatus sonoriensis* (Mearns)

SONORAN PECCARY

Tayassu angulatum sonoriense, Mearns (1907, p. 162).

Pecari angulatus sonoriensis, Miller (1924, p. 481).

Material.—1 ad. male, Aug. 15, near Bear Canyon, Tortillita Mountains.

Remarks.—This specimen is of a very old male; the tubercles on the molars are worn entirely off, leaving a smooth, polished surface. It was shot from a herd of eight or ten which probably lived near Bear Canyon. Tracks leading up the dry creek bed to a small spring at the side of the canyon, indicated that the herd frequently visited this place for water. *Ammospermophilus h. harrisii* was the only other mammal noted during the few hours spent in the Tortillita Mountains.

LIST OF MAMMALS OBSERVED OR REPORTED IN THE
REGION BUT OF WHICH NO SPECIMENS
WERE OBTAINED.

I. KIT FOX

Vulpes macrotis neomexicana Merriam

We saw a Kit Fox in captivity a few miles northwest of Tucson on August 15. The Mexican who owned it said that he had captured it on the desert when it was very young. Although necessary to keep it tied, it was quite tame.

2. COYOTE

Canis mearnsi Merriam

Coyotes were not as abundant as had been expected. The only evidence that we had of their presence was at the base of the Quinlan Mountains, June 29, where several were heard in chorus, up one of the side canyons.

3. MOUNTAIN LION

Felis concolor azteca (Merriam)

Shortly after our arrival at Old Baldy in the Santa Rita Mountains, July 13, Mr. Gilman, the fire lookout on duty at that time, told us that a few days previously a Mountain Lion had killed a deer some distance down the mountain from the cabin.

4. DEER

Odocoileus couesi (Coues and Yarrow)?

Deer were seen several times near Soldier Camp, Santa Catalina Mountains, usually in herds of three to five. They were not shy, and on several occasions I was able to approach within a few yards of them. One morning, a buck with a splendid set of antlers came within a hundred yards of camp. Deer were reported on the Santa Rita Mountains also, but we saw none there.

SUMMARY

In the present paper, a brief discussion is presented of the geography and vegetation of the region about Tucson, Arizona. Following this, twenty-three genera and twenty-nine species and subspecies of mammals are recorded and discussed at more or less length.

It is pointed out that specimens of *Otospermophilus grammurus grammurus*, *Peromyscus maniculatus rufinus*, and *Sciurus arizonensis* occurring north of the Gila and Salt Rivers on the high plateaus, are more rufous in color than specimens of the same species south of these rivers on the mountains of the Mexican Highland. The parallel of thin hairy covering and heavy pigmentation of the skin between *Ammospermophilus harrisi harrisi* and *Citellus tereticaudus neglectus*

is indicated, and it is suggested that this pigmentation may be a protection against the intense sun light.

It is pointed out that the range of *Ammospermophilus harrisi saxicola* does not extend west to the Colorado River, but that it lies south of the Gila River, and runs in a north and south, rather than in an east and west direction. The supposed presence of a colony of *Ammospermophilus harrisi harrisi* in Cataract Canyon, where it would be surrounded by *Ammospermophilus leucurus*, is noted. An attempt is made to define the range of *Ammospermophilus harrisi harrisi* in Arizona, and the unusual occurrence of *Erethizon epixanthum couesi* in the desert is recorded. Notes are presented on the life, in captivity, of a young Jack Rabbit, *Lepus californicus eremicus*. Its transportation to a mountain top is suggested as a possible cause of its death. It is noted also that faunal and floral boundaries of the region coincide with geographic boundaries, and that the Gila and Salt Rivers seem to mark the boundary of a distinct faunal area across the Mexican Highland.

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